REMARKS

Applicants are grateful to the Examiner for the Office Action of October 15, 2004.

With regard to the rejection of claims 1-31 for double patenting, applicants enclose a terminal disclaimer which addresses those rejections.

Claims 1-31 have been rejected under 35 U.S.C. §102(e) due to U.S. Pat. No. 6,226,409 (Cham et al. '409). For the following reasons, applicants respectfully request reconsideration and allowance of all claims.

In an embodiment according to the present invention, there is provided a method of tracking a target that includes modeling the target with a switching linear dynamic system (SLDS) that comprises a plurality of dynamic models. As described in the Specification at page 7, lines 11-15, these models describe a complex nonlinear dynamic system with a succession of linear models that are indexed by a switching variable. The switching approach has an appealing simplicity and, unlike prior methods, is naturally suited to the case where the dynamics are time-varying. As described at Specification page 11, line 27 to page 15, line 6, and in Figs. 1-3 of the present application, the target is modeled using a switching model 12 of Fig. 1, which has state variables s_t belonging to a set of discrete symbols. The switching model is defined by a state transition matrix, which describes how the process evolves over time. Switching state s_t determines which of S possible models are used at time t. As shown in Fig. 2, each s_t denotes an instance of one of the discrete valued action states which switch the physical system models having continuous valued states x_t and producing observations y_t. As summarized in the embodiment of Fig. 3, a dynamics learning method involves learning 32 the switching dynamics of a number of SLDS motion models from a corpus of state space motion examples 30. The parameters 36 of each SLDS are re-estimated at step 34, for example by approximate Viterbi state sequence inference.

By contrast, Cham et al. '409 describes a technique that is based on fundamentally different mathematics, which does not at all involve tracking with an SLDS model or sampling from an SLDS prediction. Instead, Cham et al. '409 involves a multiple-hypothesis tracking (MHT) approach. In this approach, it is recognized that a probability density function for fitting a model to a complex set of data often has multiple modes, each mode representing a reasonably

probable state of the model when compared with the data. For example, each of the peaks in Fig. 1 of Cham et al. '409 represents such a mode. As summarized at Col. 2, lines 10-55, Cham et al. '409 analyzes a multimodal likelihood function, such as that of Fig. 1, by numerically searching the likelihood function for peaks. The numerical search proceeds by randomly sampling from the prior distribution to select a number of seed points in state-space, and then numerically finding the maxima of the likelihood function starting from each seed point. Kernel functions are fitted to these peaks to represent the likelihood function as an analytic function. The peaks in the resulting distribution are referred to as "hypotheses," because they are hypotheses for the states of the model which best explain both the data and the prior knowledge. The technique proceeds by following the most probable set of model states into the future, and any spurious paths will usually develop low probabilities in future data frames.

By comparing the claim language of independent claims 1, 25-28, and 30 of the present invention with Cham et al. '409, applicants respectfully submit that the invention of those claims is not disclosed by Cham et al. '409.

In particular, the language of independent claim 1 includes "modeling the target with a switching linear dynamic system (SLDS) comprising a plurality of dynamic models." Corresponding elements are included in independent claims 25-28 and 30, which, although differing in detail, all include an element that models a target with a switching linear dynamic system (SLDS) that comprises a plurality of dynamic models.

No such element is disclosed in Cham et al. '409. Cham et al. '409 uses a multiple hypothesis (MHT) approach to tracking, and does not disclose modeling a target with a switching linear dynamic system (SLDS) at all. Cham et al. '409 does not disclose use of a succession of linear models that are indexed by a switching variable, and does not disclose use of a switching model defined by a state transition matrix, both of which are involved in modeling a target with an SLDS.

In fact, as described at Specification pg. 37, lines 3-13, and pg. 37, line 30 through page 38, line 6 of the present application, instead of being identical with an SLDS technique, the multiple hypothesis technique (MHT) of Cham et al. '409 may actually be used to supplement the use of an SLDS model, in accordance with an embodiment of the invention. Such a supplemental use of MHT is claimed in dependent claim 31 of the present application. For

example, as shown in Fig. 19 of the present application, the output of Viterbi prediction 510 according to the present invention is fed into a sample generator 517, which is then output to an MHT block 520. A final selector 522 may then choose S of the posterior estimates output by the MHT block, one for each possible switching state, as the final output. Thus, it can be seen that MHT techniques 520 such as that of Cham et al. '409 do not replace an embodiment according to the independent claims, but instead may be involved, for example, in the Viterbi prediction 510 and sample generation 517 blocks; i.e. generally, used in addition to such SLDS techniques (as in block 520).

Applicants respectfully traverse the statements in the Office Action with regard to the novelty of the independent claims over Cham et al. '409. With regard to claim 1, the passage at Col. 4, lines 53-62 of Cham et al. '409 only discloses that an MHT technique may be used in radar tracking, and that there may be a sequence of frames indicating the motion of an object; but does not disclose the use of an SLDS model for tracking. The passage at Col. 6, lines 51-54 only refers to calculation of the prior distribution of Fig. 1 using "the dynamic model," meaning the dynamic model of Cham et al. '409, which involves an MHT tracking technique; but does not disclose use of a switching linear dynamical system (SLDS) model. Similar comments apply to the rejection of independent claims 25-28 and 30.

It is therefore submitted that independent claims 1, 25-28, and 30 are not disclosed by the cited art. Therefore the §102 rejection of claims 1-31 is believed to be overcome such that acceptance is respectfully requested.

Dependent claims 2-24, 29, and 31 depend from base claims 1, 28, and 30, and thus the foregoing arguments apply.

CONCLUSION

In view of the above remarks, it is believed that all claims (claims 1-31) are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

HAMILTON, BROOK, SMITH & REYNOLDS, P.C.

By _____
Mary Lou Wakimura
Registration No. 31,804
Telephone: (978) 341-0036
Facsimile: (978) 341-0136

Concord, MA 01742-9133
Dated: 11/4/05